

**CLAIMS:**

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent is:

1        1. In a networking environment comprising one or more network processing (NP)  
2        devices for routing data packets from a source to a destination via a switch fabric,  
3        with each network processing device supporting a number of interface ports, a  
4        system for ensuring packet routing from one network processing device to a target  
5        network processing device via a target interface port, said system comprising:

6                mechanism for tracking operational status of each network processor  
7        device and operational status of destination ports supported by each said network  
8        processor device in said system, said operational status being maintained at each  
9        network processing device;

10               said network processor devices including mechanism for determining the  
11        operational status of a target network processing device and target interface port  
12        of a current packet to be routed prior to said routing,

13               routing mechanism for routing packets from source NP devices to  
14        destination NP devices and destination ports thereof in accordance with a packet  
15        routing protocol, said routing mechanism routing said current packet to a target  
16        network processor device and destination port when said target network processor  
17        device and destination ports thereof are determined as operational, and routing  
18        packets to another operational NP device and port thereof upon determination of  
19        non-operational target network processor device and destination port, whereby  
20        proper routing of packets is guaranteed with minimum packet lost.

1        2. The system for ensuring packet routing in accordance with Claim 1, wherein  
2        said routing mechanism implements an Equal Cost Multi-Path ECMP protocol  
3        including next hop routing table for mapping a destination address associated with

4 a packet to be forwarded to one or more next hop options in said networking  
5 environment.

1 3. The system for ensuring packet routing in accordance with Claim 1, wherein  
2 each network processor device maintains a data structure receiving values from  
3 said tracking mechanism indicating status of said network processor devices, said  
4 determining mechanism implementing logic for comparing said received value  
5 against a first value indicating all NP devices are operational prior to routing of a  
6 current packet, and initiating routing of said packet to said target when said values  
7 match.

1 4. The system for ensuring packet routing in accordance with Claim 3, wherein  
2 said received value is a second value representing a particular NP device that is  
3 not operational, said determining mechanism implementing logic for comparing a  
4 bit representation of a target NP device of a packet to be routed against this  
5 received second value and initiating routing of said packet to another NP device  
6 when said target NP device is not operational.

1 5. The system for ensuring packet routing in accordance with Claim 1, wherein  
2 each network processor device maintains a data structure receiving values from  
3 said tracking mechanism indicating status of said network processor devices, said  
4 determining mechanism implementing logic for comparing said received value  
5 against a first value indicating all interface ports for said NP devices are  
6 operational prior to routing of a current packet, and initiating routing of said  
7 packet to said NP device and target port when said values match.

1 6. The system for ensuring packet routing in accordance with Claim 5, wherein  
2 said first value includes a set of mask bits and a set of bits representing said target  
3 destination port, said determining mechanism implementing bitwise logic for

4 comparing said received value against said mask bit set and obtaining a first  
5 result, comparing said first result against said target destination port bits, and  
6 initiating re-routing of said packet to another destination port when said first  
7 result does not match said target destination port bits.

1 7. The system for ensuring packet routing in accordance with Claim 5, wherein  
2 said data structure receives two values defining a range of NP devices that are not  
3 operational, said determining mechanism implementing logic for comparing a bit  
4 representation of a target NP device of a packet to be routed against said each of  
5 said two values defining said range, and initiating re-routing of said packet to  
6 another destination port outside said range when said bit representation of said  
7 target NP device falls within said two values.

1 8. A method for ensuring packet routing in a networking environment comprising  
2 one or more network processing (NP) devices for routing data packets from a  
3 source to a destination via a switch fabric, with each network processing device  
4 supporting a number of interface ports, said method comprising the steps of:

- 5 a) tracking operational status of each network processor device and  
6 operational status of destination ports supported by each said network processor  
7 device in said system, and maintaining said operational status at each network  
8 processing device;
- 9 b) determining the operational status of a target network processing device  
10 and target interface port of a current packet to be routed prior to said routing at a  
11 current NP device; and,
- 12 c) routing packets from source NP devices to destination NP devices and  
13 destination ports thereof in accordance with a packet routing protocol, a current  
14 packet being routed to a target network processor device and destination port  
15 when said target network processor device and destination ports thereof are  
16

16 determined as operational, or being routed to another operational NP device and  
17 port thereof upon determination of non-operational target network processor  
18 device and destination port, whereby proper routing of packets is guaranteed with  
19 minimum packet lost.

1 9. The method for ensuring packet routing in accordance with Claim 8, wherein  
2 said routing of packets from source NP devices to destination NP devices and  
3 destination ports thereof is in accordance with Equal Cost Multi-Path (ECMP)  
4 protocol, said routing step c) including mapping a destination address associated  
5 with a packet to be forwarded to one or more next hop options in said networking  
6 environment.

1 10. The method for ensuring packet routing in accordance with Claim 8,  
2 wherein said step of maintaining said operational status includes maintaining a  
3 data structure for receiving values determined from said tracking step indicating  
4 status of said network processor devices.

1 11. The method for ensuring packet routing in accordance with Claim 10, wherein  
2 said determining step b) includes the step of implementing logic for comparing a  
3 received value against a first value indicating all NP devices are operational prior  
4 to routing of a current packet, and initiating routing of said packet to said target  
5 when said values match.  
6

1 12. The method for ensuring packet routing in accordance with Claim 11, wherein  
2 said received value is a second value representing a particular NP device that is  
3 not operational, said determining step b) including the step of implementing logic  
4 for comparing a bit representation of a target NP device of a packet to be routed  
5 against this received second value and initiating routing of said packet to another  
6

NP device when said target NP device is not operational.

13. The method for ensuring packet routing in accordance with Claim 10, wherein said determining step b) includes the step of implementing logic for comparing said received value against a first value indicating all interface ports for said NP devices are operational prior to routing of a current packet, and initiating routing of said packet to said NP device and target port when said values match.

14. The method for ensuring packet routing in accordance with Claim 13, wherein said first value includes a set of mask bits and a set of bits representing said target destination port, said determining step b) including the step of implementing bitwise logic for comparing said received value against said mask bit set and obtaining a first result, comparing said first result against said target destination port bits, and initiating re-routing of said packet to another destination port when said first result does not match said target destination port bits.

15. The method for ensuring packet routing in accordance with Claim 13, wherein said data structure receives two values defining a range of NP devices that are not operational, said determining step b) implementing logic for comparing a bit representation of a target NP device of a packet to be routed against said each of said two values defining said range, and initiating re-routing of said packet to another destination port outside said range when said bit representation of said target NP device falls within said two values.

16. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for ensuring packet routing in a networking environment comprising one or more network processing (NP) devices for routing data packets from a source to a

5 destination via a switch fabric, with each network processing device supporting a  
6 number of interface ports, said method steps comprising:

- 7 a) tracking operational status of each network processor device and  
8 operational status of destination ports supported by each said network processor  
9 device in said system, and maintaining said operational status at each network  
10 processing device;  
11 b) determining the operational status of a target network processing device  
12 and target interface port of a current packet to be routed prior to said routing at a  
13 current NP device; and,  
14 c) routing packets from source NP devices to destination NP devices and  
15 destination ports thereof in accordance with a packet routing protocol, a current  
16 packet being routed to a target network processor device and destination port  
17 when said target network processor device and destination ports thereof are  
18 determined as operational, or being routed to another operational NP device and  
19 port thereof upon determination of non-operational target network processor  
20 device and destination port, whereby proper routing of packets is guaranteed with  
21 minimum packet lost.

1 17. The program storage device readable by a machine in accordance with Claim  
2 16, wherein said routing of packets from source NP devices to destination NP  
3 devices and destination ports thereof is in accordance with Equal Cost Multi-Path  
4 (ECMP) protocol, said routing step c) including mapping a destination address  
5 associated with a packet to be forwarded to one or more next hop options in said  
6 networking environment.

1 18. The program storage device readable by a machine in accordance with Claim  
2 16, wherein said step of maintaining said operational status includes maintaining a  
3 data structure for receiving values determined from said tracking step indicating  
4 status of said network processor devices.

1 19. The program storage device readable by a machine in accordance with Claim  
2 18, wherein said determining step b) includes the step of implementing logic for  
3 comparing a received value against a first value indicating all NP devices are  
4 operational prior to routing of a current packet, and initiating routing of said  
5 packet to said target when said values match.

1 20. The program storage device readable by a machine in accordance with Claim  
2 19, wherein said received value is a second value representing a particular NP  
3 device that is not operational, said determining step b) including the step of  
4 implementing logic for comparing a bit representation of a target NP device of a  
5 packet to be routed against this received second value and initiating routing of  
6 said packet to another NP device when said target NP device is not operational.

1 21. The program storage device readable by a machine in accordance with Claim  
2 20, wherein said determining step b) includes the step of implementing logic for  
3 comparing said received value against a first value indicating all interface ports  
4 for said NP devices are operational prior to routing of a current packet, and  
5 initiating routing of said packet to said NP device and target port when said values  
6 match.

1 22. The program storage device readable by a machine in accordance with Claim  
2 21, wherein said first value includes a set of mask bits and a set of bits  
3 representing said target destination port, said determining step b) including the  
4 step of implementing bitwise logic for comparing said received value against said  
5 mask bit set and obtaining a first result, comparing said first result against said  
6 target destination port bits, and initiating re-routing of said packet to another  
7 destination port when said first result does not match said target destination port  
8 bits.

1        23. The program storage device readable by a machine in accordance with Claim  
2        18, wherein said data structure receives two values defining a range of NP devices  
3        that are not operational, said determining step b) implementing logic for  
4        comparing a bit representation of a target NP device of a packet to be routed  
5        against said each of said two values defining said range, and initiating re-routing  
6        of said packet to another destination port outside said range when said bit  
7        representation of said target NP device falls within said two values.

TO: 14248-12649350